Prof. Dr W. DE BREUCK

LABORATORIUM VOOR TOEGEPASTE GEOLOGIE EN HYDROGEOLOGIE

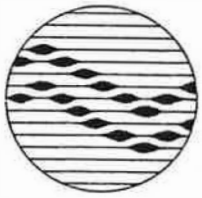
HYDROGEOLOGIC SURVEY AT A 1,1,1-TRICHLOROETHANE STORAGE TANK SITE OF RANK XEROX PLANT AT ZAVENTEM

RIJKSUNIVERSITEIT GENT

RIJKSUNIVERSITEIT
GENT

laboratorium voor
toegepaste geologie
en hydrogeologie

HYDROGEOLOGIC SURVEY AT A 1-1-1-TRICHLOROETHANE STORAGE TANK SITE OF RANK XEROX PLANT AT ZAVENTEM



geologisch instituut S8
krijgslaan 281
B-9000 gent

telefoon 091-22.57.15

A.I.B.
André Drouartlaan 29
1160 BRUSSEL

Direction : Prof. Dr. W. DE BREUCK
Report : Lic. M. MAHAUDEN

Research nr. : TGO 89/51
Date : September 7th, 1989

HYDROGEOLOGIC SURVEY AT A 1,1,1-TRICHLOROETHANE STORAGE TANK SITE OF RANK XEROX PLANT AT ZAVENTEM

1. INTRODUCTION

By order of A.I.B. the Laboratory of Applied Geology and Hydrogeology of the State University of Ghent carried out an hydrogeologic investigation at a 1,1,1-trichloroethane (TCA) storage tank site of the RANK XEROX plant at Zaventem.

The programme of the work to be performed was decided by A.I.B. and RANK XEROX representatives. The hydrogeologic investigation consisted of :

- drilling and sampling of four holes near the tank site
- equipment of one borehole as an observation well
- leveling and measurement of the groundwater level
- determination of the general ground water flow direction
- sampling of the groundwater.

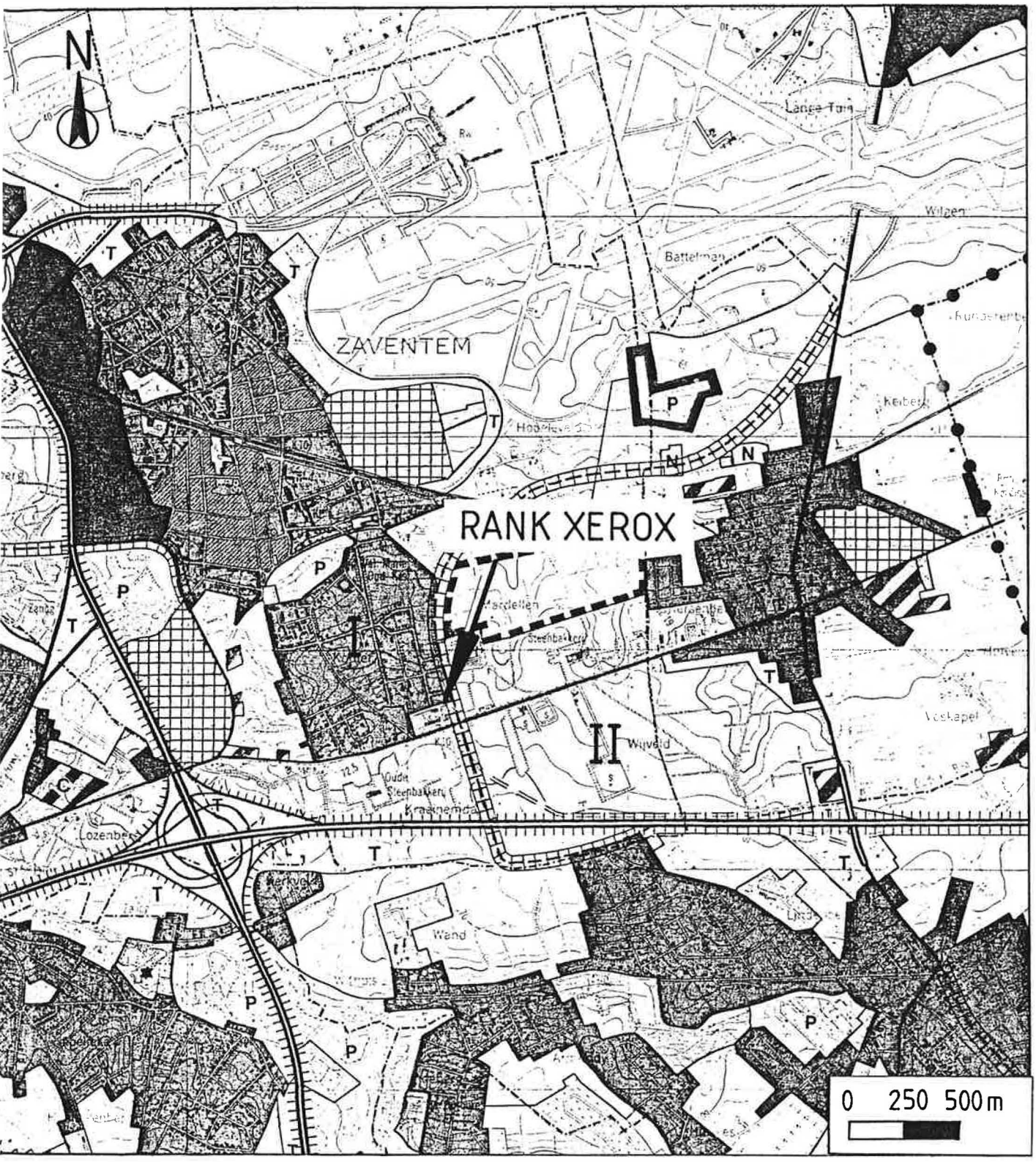
The investigation started on August 29th 1989. This report contains an overview of the performed work.

2. SITE DESCRIPTION

2.1. Location

The RANK XEROX industrial building is located at Zaventem near the Leuvense Steenweg in an area reserved for traditional, small or medium-sized companies. The area borders the residential area of the Zaventem village (fig. 1).

Two underground tanks containing respectively clean TCA and "waste" TCA are located near the exterior building of the refurbishing workshop area. The exact position of both tanks, in use since 1968-69, is unknown (fig. 2).



I — Residential area

II — Area reserved for traditional, small or medium-sized companies

Fig. 1 - Print of the County Plan at Zaventem (Department for Regional Economy, Environmental Planning and Housing)

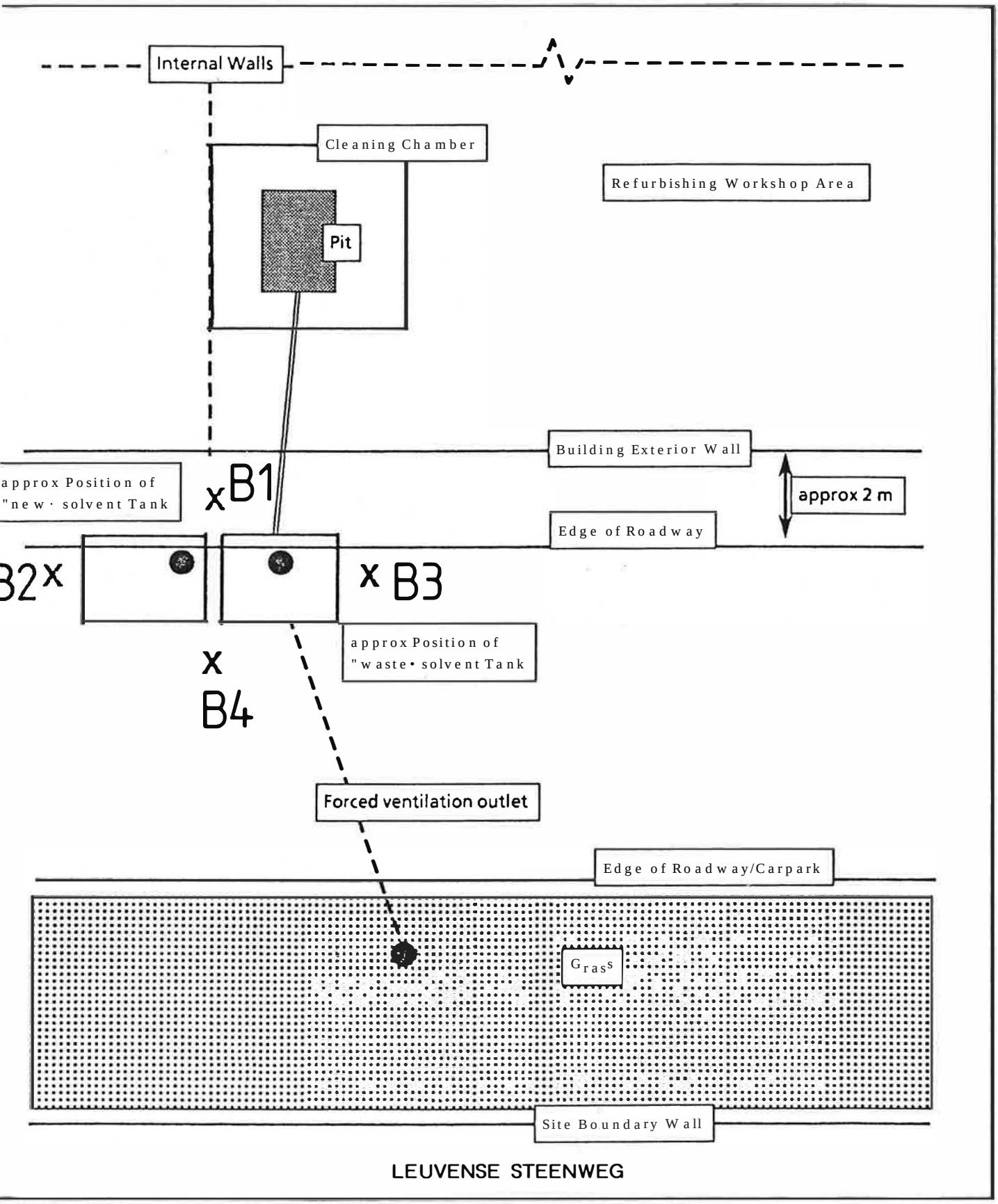


Fig. 2 - Diagram showing relative positioning of TCA tanks and performed drillholes (not to scale)

2.2. Physiography

The industrial building is located on a ridge, the level of which attains approximately 68 m above sealevel*. The ridge is oriented from west to east and bordered to the north by the "Kleine beek" at approximately +40 and to the south by the "Kleine Maalbeek" at approximately +47 (fig. 3).

In earlier time silts have been extracted at the RANK XEROX area for brickmaking.

3. GEOLOGY

The regional geology at the Zaventem area is illustrated on fig. 4. This generalised chronostratigraphic section shows the sequence of the different groups or formations of Paleozoic, Mesozoic and Cainozoic age; the niveo-aeolian silts of Pleistocene age are not represented. The lithology and spatial distribution are treated in following paragraphs.

3.1. Paleozoic

The Paleozoic is composed of shales and quartzites. The top of these rocks is encountered at approximately -96.

3.2. Mesozoic

The Mesozoic deposits are of Cretaceous, Senonian age (Campanian). They consist of chalk containing chert nodules. The top of these sediments occurs at approximately -72.

* All levels in this report refer to the datum level of the National Geographic Institute (Second General Leveling = TAW)

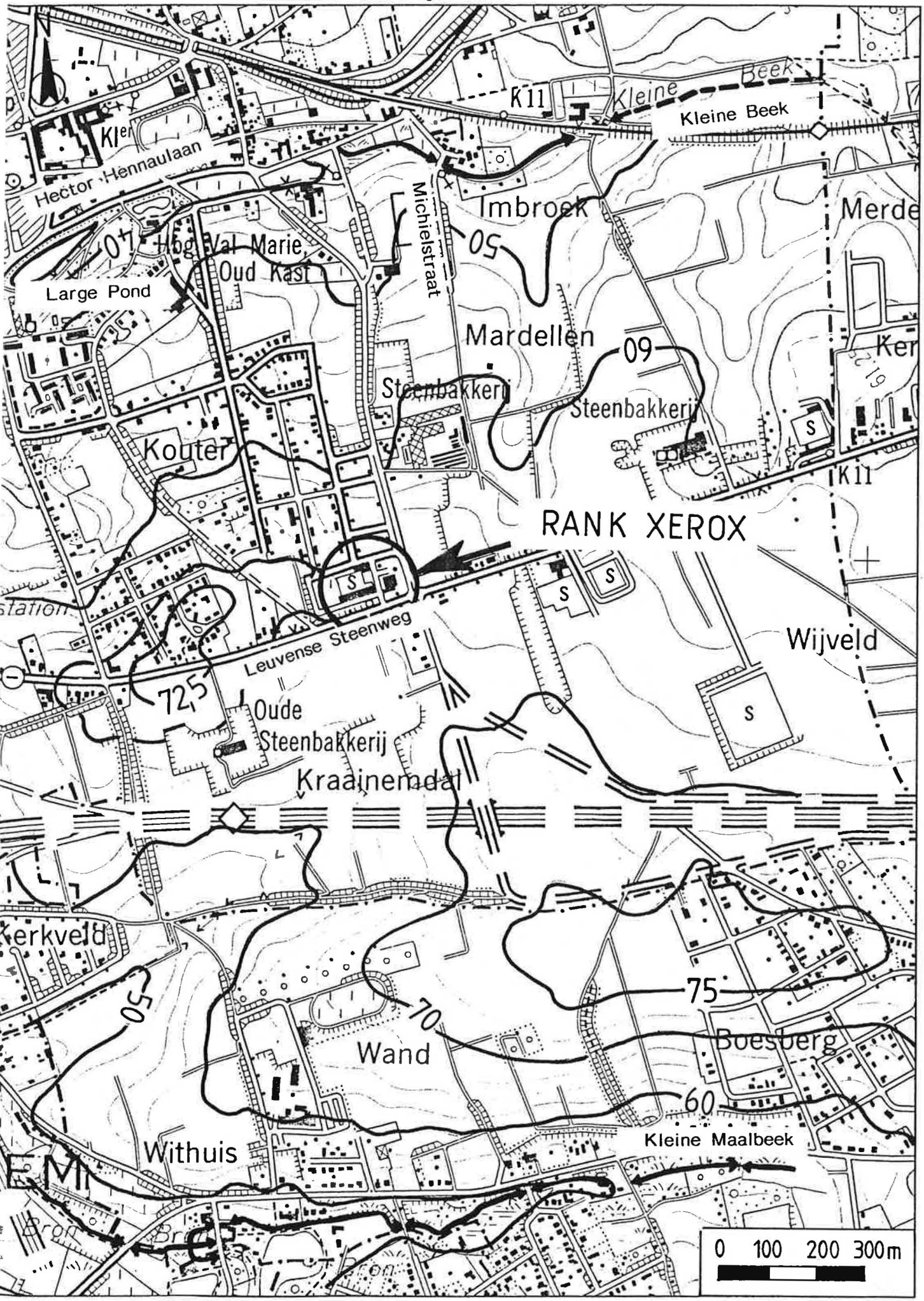
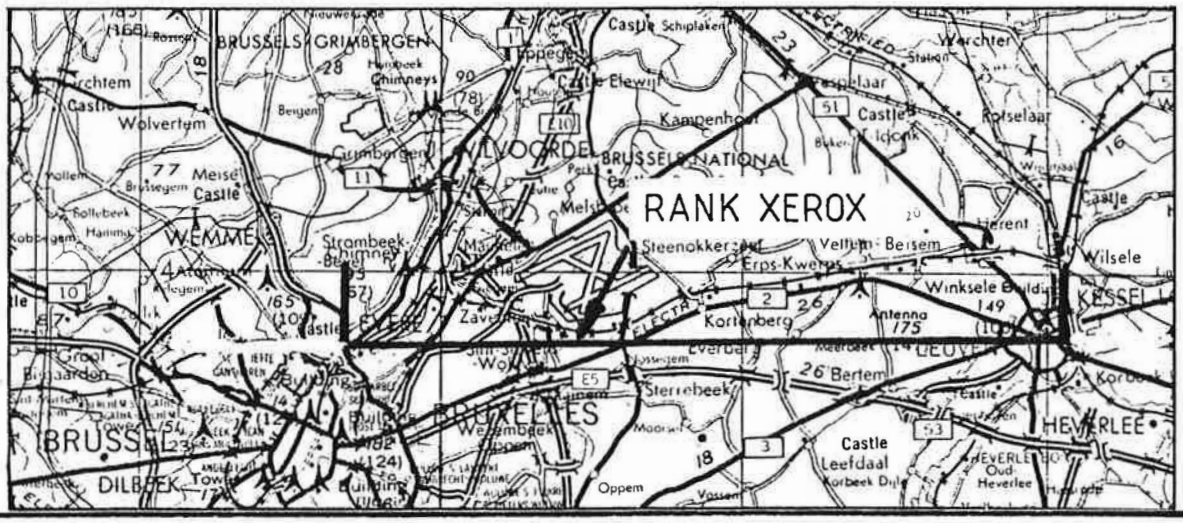


Fig. 3 - Print of the topographic map 31/4 Zaventem (NGI)
Contourline interval 0,25 m



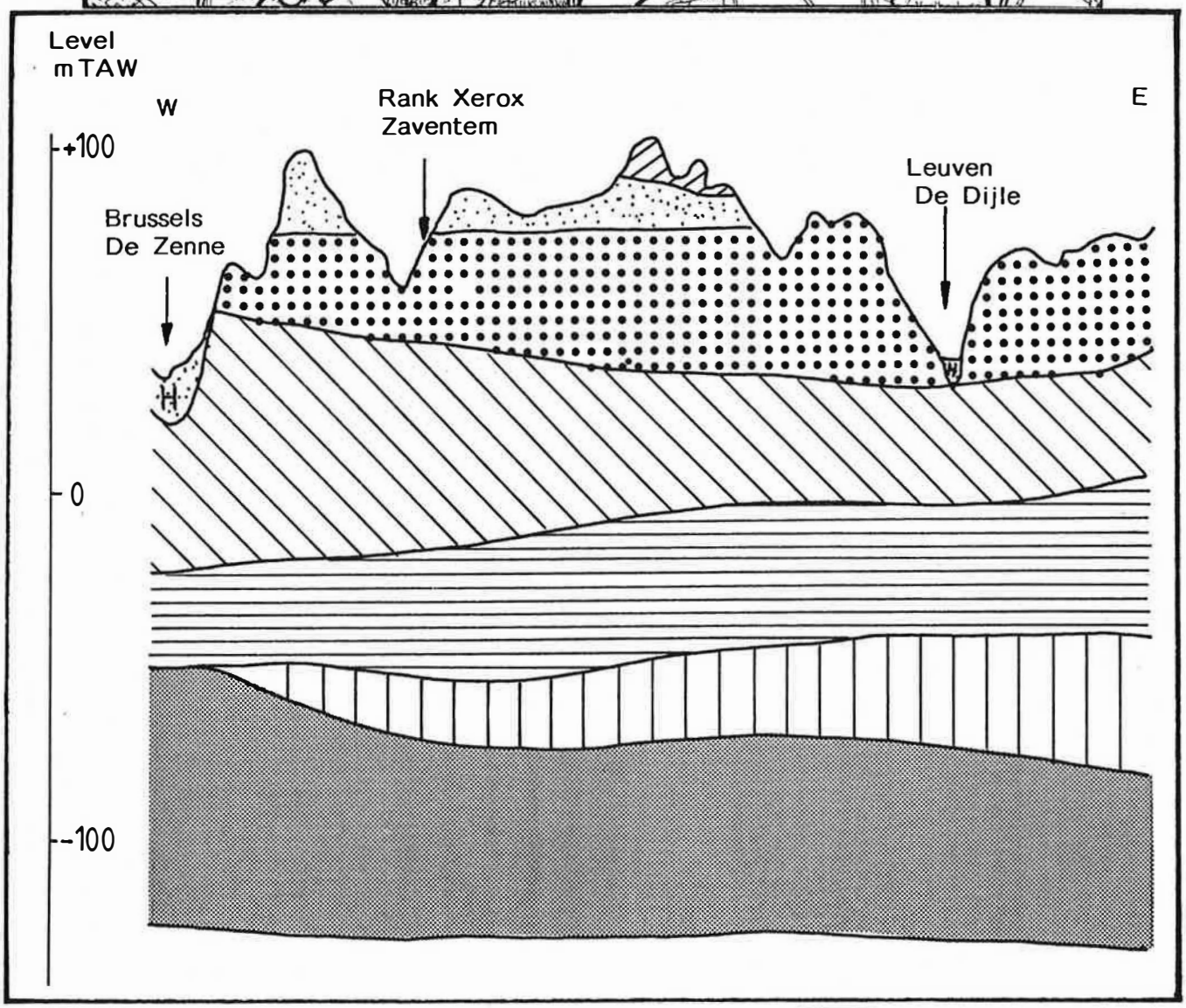


Fig. 4 - Chronostratigraphic section Brussels-Leuven representing the regional geology

3.3. Cainozoic

The Cainozoic is composed of Paleocene and Eocene (Tertiary) sediments. From bottom to top these are :

- the Landen Group (Paleocene), consisting of fine green sand, clayey sand and clay. These sediments contain discontinuous sandstone levels. The top of the Landen Group is situated at approximately -40
- the Ieper Group (Lower Eocene); here two distinct facies can be distinguished. The lower part, some 50 m thick, consists of grayish green clay, the upper part, some 15 m thick, of mainly green sand with sandy clay layers. The top of the Ieper Group is at approximately +25
- the Zenne Group (Middle Eocene) which at the RANK XEROX site is formed by the Brussel Formation; it is composed of sand that at some places can be calca reous. Frequently sandstone levels (sometimes calcareous) or nodular sandstones are encountered.

The sand of the Brussel Formation is covered by niveo-aeolian silt of Pleistocene age.

4. HYDROGEOLOGY

The lithology of the sediments encountered at the RANK XEROX area at Zaventem (see chapter 3) reflects the general hydrogeologic situation. The sandy Brussel Formation and Ieper Formation (upper part) form an unconfined aquifer; the lower clayey part of the Ieper Formation acting as an impervious stratum forms the base of the unconfined aquifer.

The Brussel Formation is an important aquifer in the Brussels region; the hydraulic conductivity of this aquifer is 2.10^{-4} $m.s^{-1}$. The "Vlaamse Maatschappij voor Watervoorziening", a public water supply company extracts groundwater at several places in the Brussels-Leuven region in the Brusselian aquifer.

5. DRILLING AND SAMPLING

Four boreholes (fig. 2) were performed near the tanks by the drilling contractor P.V.B.A. GEOLAB. The first hole B1 was drilled at approximately the same place where in 1987 the presence of TCA was demonstrated in a soil sample at a depth between 3 and 4 m. If a normal lithologic sequence is present at the tank site one can expect that the borehole location is probably in the direction of the groundwater movement (cfr. chapter 8).

The drilling was made by a solid-stem auger with a single flight (diameter 0.17 m) in the insaturated zone. Beneath the water table drilling was performed by driving a casing and bailing (outer diameter 0.150 m). Representative formation samples were collected at depth intervals of 0.5 m. Undisturbed samples (diameter 0.100 m) were taken, at depths indicated by the owner and the project representative, by the core barrel method (tab. 1). After withdrawal the undisturbed samples were immediately covered and stored in a freezer. The representative samples to be analysed were handled in the same way.

Table 1 - Depths in m below ground surface of the collected undisturbed formation samples

Drillhole nr. / Depth (m)	B1 depth 30 m	B2 depth 6 m	B3 depth 6 m	B4 depth 6 m
3 - 3,4	X	X	X	X
3,6 - 4,0	X			
5,0 - 5,4	X	X	X	X
17,2 - 17,6	X			
23,2 - 23,45	X			

During drilling operations precautions were taken to avoid any contamination of the formation samples or the groundwater itself. The water volume used during the drilling operation was limited to a strict minimum.

The colour as mentioned in the descriptive lithologic log refers to the revised standard soil colour charts prepared by the National Institute of Agricultural Science and the Forest Experiment Station in co-operation with the Japan Color Research Institute (1967).

Descriptive lithologic (stratigraphic) log of B1.

Sample description	Depth in m
yellowish brown 10YR5/8 silt, calcareous with brick fragments	0,0 - 1,0
brown 10YR4/6 silt, calcareous	1,0 - 1,5
brown 10YR4/6 silt, calcareous with fibrous white inclusions. At 4,8 to 4,9 numerous flattened chert nodules	1,5 - 4,9
bright yellowish brown 10YR6/8 fine sand	4,9 - 5,5
olive yellow 7,5Y6/3 fine sand	5,5 - 6,0
bright brown 7,5Y5/8 fine sand with thin ferrugineous sandstone layer at 6,3 (0,05 m thick)	6,0 - 6,35

olive yellow 7,5Y6/3 fine sand	6,35- 7,0
bright yellowish brown 2,5Y6/6 very fine to fine sand	7,0 - 8,0
olive yellow 7,5Y6/3 very fine to fine sand	8,0 - 8,5
bright yellowish brown 2,5Y6/6 very fine to fine sand	8,5 - 9,0
light yellow 7,5Y7/3 very fine to fine sand	9,0 -15,0
olive yellow 7,5Y6/3 very fine to fine sand	15,0 -16,0
olive 5Y6/6 fine sand with some very thin bright yellowish brown 2,5Y6/8 sandy clay layers	16,0 -16,5
bright yellow 10YR6/8 fine sand with a lentil of coarse angular sand at 17,3-17,4 m depth	16,5 -19,5
yellowish brown 2,5Y5/4 medium sand with some smal sandy clay inclusions	19,5 -20,0
bright yellowish brown 2,5Y6/8 medium to fine sand with thin intercalated sandstone layers at 21,6 and 23,4 m depth. Filled wormhole with sandstone concretation at 20,8 m depth ?	20,0 -24,0
bright yellowish brown 10YR6/8 fine sand with some thin sandstone intercallations. Ferrugineous sandstone concretion at 26,6 m depth	24,0 -27,5
olive yellow 7,5Y6/3 to light yellow 7,5Y7/3 fine sand, sandstone layer from 29,5 to 29,8 m depth	27,5 -30,0

Stratigraphic interpretation.

From 0,0 - 1,0 m fill up
1,0 - 4,9 m Pleistocene
4,9 -30,0 m Brussel Formation (Middle Eocene)

The water table was encountered at approximately 23,4 m depth (undisturbed sample).

From a depth of 1,5 m a notable smell of TCA was found. The smell decreased with the depth of the hole, but remained notable till 16 m or more ? Because of the olfactory adaption this is a rough estimation. The analysers of the formation and groundwater samples will provide a preciser picture.

A log of the encountered formation at B2, B3 and B4 is not given; therefore one can refer to B1 (0 to 6 m depth). At B2 site no smell of TCA was found; at B3 site it was doubtful but at B4 a notable smell (less than at B1) was found from a depth of 2,0 m.

6. EQUIPMENT OF THE OBSERVATION WELL

Borehole B1 is equiped as an observation well; the construction log is represented on fig. 5. To prevent contamination during the construction :

- no soil withdrawn from the borehole has been used as fill up
- no glue was used to joint the PVC pipes.

After the equipment and before groundwater sampling the observation well has been developed.

7. LEVELING AND WATER-LEVEL MEASUREMENTS

7.1. Leveling

The top of the riser pipe at B1 has been leveled. The marker at the petrol station (MN42 of NGI) in front of the RANK XEROX industrial building has been used as a reference point. The threshold at the entrance beside the refurbishing workshop has also been leveled.

In the village of Zaventem the water surface of the "Kleine Beek" and the large pond in the communal park have also been leveled. Here a marker point (NI21 of NGI) in the village was used.

The results of the leveling are collected in table 2.

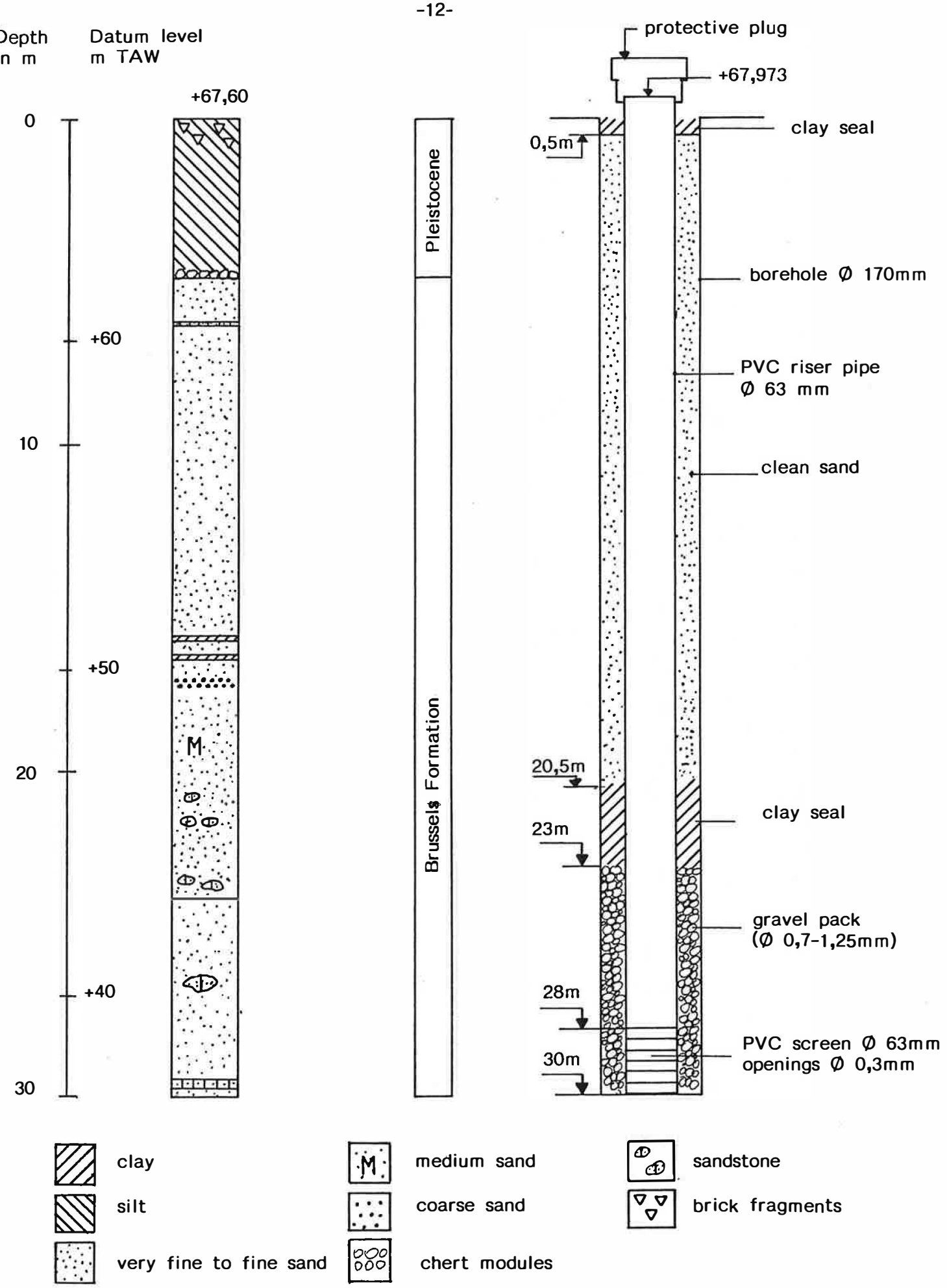


Fig. 5 - Construction log of the observation wel at B1 site

Table 2 - Levels at RANK XEROX area and in Zaventem village

Description of leveled point	Level in m TAW
- top riser tube at B1	+67,973
- threshold at entrance beside refurbishing workshop	+67,817
- large pond in communal park Hector Hennaulaan	+35,928*
- Kleine Beek at Michielstraat	+40,428*

* on september 4th 1989

7.2. Groundwater level measurement

On September 4th 1989 the groundwater level in the unconfined aquifer at B1 was +43,938.

8. GENERAL GROUNDWATER FLOW

From the topographic map at scale 1:10.000 (fig. 1) one can determine approximately the general groundwater flow direction in the unconfined aquifer. This however supposes the absence of any anthropogenic influence such as i.e. groundwater extraction or infiltration in the close vicinity of the RANK XEROX area.

The general groundwater flow will probably be directed towards the N, into the direction of the Kleine beek. However more precision concerning the direction and the gradient requires at least two supplementary observation wells.

Taking into account the leveling results (chapter 7.1) the average gradient of the watertable between the RANK XEROX area at B1 and the Kleine beek is approximately 0,6 %.

9. GROUNDWATER SAMPLING

After development of the observation well groundwater samples were taken on September 4th 1989. Before taking the samples the bore volume was pumped several times. The sampling was performed with a PTFE TIMCO Isomega Bladder Pump.

10. SAMPLE ANALYSIS

The formation samples, undisturbed and representative samples as well as the groundwater samples will be analysed by A.I.B.

September 7th, 1989.